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REPORTED ANIMAL RABIES IN ARKANSAS: 1982-1990

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ABSTRACT

Reported animal rabies in Arkansas is reviewed for the years 1982-1990; providing an update from 1950-1981 (Heidt, 1982). Total cases ranged from 39 in 1990 to 168 in 1986, with a mean of 123.1. Wildlife accounted for 93.4% of the total cases. A total of 16 kinds of mammals has been implicated in reported rabies (individual species of foxes and skunks have been combined). The four taxa accounting for the highest incidence are: skunks (82.6%); bats (10.1%, all seven species combined); cattle (2.8%); and dogs (1.5%). Skunks, the most prominent species, ranged from 71.8% in 1990 to 90.2% in 1987. These figures were similar to the previous ten years, with the exception of 1977-1979 when Arkansas experienced a severe skunk rabies epizootic.

INTRODUCTION

In 1982, Heidt published a comprehensive review of reported animal rabies in Arkansas, covering the years 1950-1981. In that study he pointed out that the first known case of rabies in Arkansas dated from the late 1880's when a human death was recorded in Garland County. He further reported that actual statistical data were not compiled until 1940 and that a breakdown by species was not begun until 1946.

During the 31 years covered by that review, Arkansas contributed significantly to the annual national total of reported rabies (mean of 3.4% per year), and had experienced a skunk rabies epizootic in the late 1970's (Heidt, 1982; Heidt *et al.*, 1982.).

Reported bat rabies, while recorded, was not delineated by species. In July, 1982 one of the authors (DAS) began to routinely identify bats tested by the Arkansas Department of Health; a practice still being continued. In light of the identification of bats tested, McChesney *et al.* (1983) reviewed reported bat rabies for 1982 and Heidt *et al.* (1987) reviewed reported bat rabies between 1982-1986.

The purpose of this study was to update reported animal rabies in Arkansas for the years 1982-1990, thus providing current summaries on this important disease. The number of reported rabies cases can be influenced by a number of factors including public awareness, number of animal bites, proximity to health departments, previous experience with animal rabies, and human population densities (Verts and Storm, 1966; Lewis, 1972; Carey *et al.*, 1978). Furthermore, untold numbers of animal rabies cases go undetected due to the secretive or nocturnal habits of most animals, lack of human presence in a given epizootic area, quickness of death once there is an onset of symptoms, and most rabies cases are expressed in the 'dumb' rather than 'furious' form (McLean, 1970; Kaplan and Koprowski, 1980). Reported rabies, however, is a useful tool for showing trends and epizootics.

METHODS AND MATERIALS

Data for the Arkansas portion of the study were compiled from annual data supplied by the Arkansas Department of Health (ADH). Supplementary information was obtained through several conversations with Dr. Thomas C. McChesney of the ADH. National reported rabies data were

compiled from several publications of the National Centers for Disease Control (CDC, 1983, 1984, 1985, 1986, 1987, 1989).

RESULTS AND DISCUSSION

GENERAL ASPECTS

The Division of Laboratories of the Arkansas Department of Health is responsible for testing all specimens which are submitted by concerned individuals. Over the past nine years a total of 12,185 (\bar{x} = 1354) specimens has been examined. Of the submitted specimens, 1076 (8.8%) have tested positive (ranging from 3.4-13.2%). This relatively low percentage is due, in part, to the submission of rodents, opossums, and raccoons. These three groups totaled 2097 specimens (16.4% of total submissions); one raccoon tested positive.

Total reported cases of rabies in Arkansas (1982-1990) ranged from a low of 39 in 1990 to a high of 168 in 1986, with a mean of 120 cases per year (Table 1, Fig. 1). This pattern continues the previous 31 year history

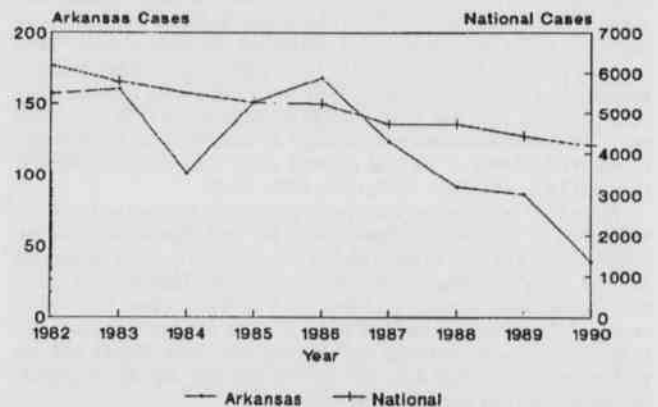


Figure 1. Total Arkansas and national reported cases of rabies: 1982-1990.

Reported Animal Rabies in Arkansas: 1982-1990

Table 1. Reported animal rabies in Arkansas: 1982-1990. Parentheses indicate percentages.

YEAR	DOG	CAT	CATTLE	HORSE	MISC. DOMESTIC	FOX	SKUNK	BAT ^a	MISC. WDLF	TOTAL	NATIONAL	%NATIONAL
1982	4(2.5)	2(1.3)	4(2.5)			2(1.3)	126(80.3)	19(12.1)		157	6193	2.5
1983	4(2.5)	1(0.6)	7(4.4)	2(1.2)		2(1.2)	128(80.0)	16(10.0)		160	5798	2.8
1984	1(1.0)	2(2.0)	2(2.0)				80(80.0)	16(16.0)		101	5508	1.8
1985	1(0.7)	1(0.7)	4(2.6)		1(0.7) ^b		131(86.8)	13(8.6)		151	5269	2.8
1986	2(1.2)	3(1.8)	2(1.2)	2(1.2)		1(0.6)	143(85.1)	14(8.3)	1(0.6) ^c	168	5242	3.2
1987	3(2.4)	1(0.8)	4(3.3)				111(90.2)	2(1.6)	2(1.6) ^d	123	4729	2.6
1988	1(1.1)		3(3.3)	2(2.2)		1(1.1)	76(83.5)	8(8.8)		91	4724	1.9
1989	2(2.3)	1(1.2)	3(3.5)	4(4.6)			67(77.9)	9(10.5)		86	4430	1.9
1990			1(2.6)				28(71.8)	9(23.1)		39	4191	0.9
TOTAL	18(1.7)	11(1.0)	30(2.8)	10(0.9)	1(0.7)	6(0.6)	890(82.7)	106(9.8)		1076	46084	2.3
	a - includes seven species				b - goat		c - coyote		d - coyote and raccoons			

of peaks and troughs (Heidt, 1982). During the previous 31 years there were seven transient and two major peaks of rabies activity. The years encompassed by the present study demonstrate one peak and two troughs; the relatively high numbers in 1982 and 1983 represent a declining plateau following the major skunk epizootic seen in 1977-79. This general cyclical pattern of transient increases and decreases followed by a major outbreak has been reported in other states (Sanderson *et al.*, 1967; Friend, 1968; Hall, 1978; Wampler and Kirkland, 1981). In Arkansas, the major peaks of activity have appeared approximately every 10 years, last occurring in 1979 (Heidt, 1982). If the general pattern holds true, another major peak of activity should occur within the next 2-3 years.

Over the past nine years, 70 of Arkansas' 75 counties have reported at least one case of rabies. On the average 39.2 counties have reported rabies each year (ranging from 23 counties in 1990 to 46 counties in 1982 and 1986).

Figure 1 compares total reported rabies in Arkansas with that in the United States. National rabies has shown a steady decline over the past nine years, while Arkansas experienced a peak in 1985-86. During the past nine years, Arkansas contributed an average of 2.3% (ranging from 0.9-3.2%) of the nation's reported rabies (Table 1); down about a percentage point from the previous 31 years.

Reported animal rabies for this study are summarized in Table 1. Sixteen different kinds of mammals (no distinction is made between individual species of skunks and foxes) have been reported with laboratory confirmed rabies. Five of these are considered domestic animals, while the other 11 are classified as wildlife. Heidt (1982) reported that domestic animal rabies predominated until 1963 when cases were approximately equal. Between 1963 and 1981, wildlife rabies averaged 84% of the total cases. This trend continued even stronger as wildlife rabies has averaged 93.4% (91.3-97.4%) of the total reported cases. Nationally, this trend is similar (CDC, 1983, 1984, 1985, 1986, 1987, 1989).

Since 1975 when proper vaccination procedures for dogs and cats was established by law, rabies in these species has been dramatically reduced. Reported rabies in each of these species averages less than 2% of the total reported rabies and appears to be rather insignificant. Bovine rabies is also rather insignificant, averaging 2.8% (1.2-4.4%) of total cases. It should be cautioned, however, that cases of rabies in cattle may go unreported due to the difficulties in obtaining and shipping specimens. Horses and one goat represent the other domestic species and they are also negligible (horses average less than 1% of the total cases).

A total of 1288 rodents and rabbits has been submitted for testing. None of these animals has tested positive and over the past 40 years only 4 rodents have tested positive in Arkansas. It is impossible to determine,

however, how many of the specimens are household pets which would be very unlikely to have the disease. Nationally, rodents account for a disproportionate number of animal examinations. For example, Fishbein *et al.* (1986) reported that in 1984, rodents represented 10.1% of the 87,870 animals examined for rabies in the United States, but only 29 (0.5%) of the 5,547 positive animals were rodents and lagomorphs. Moro *et al.* examined rodent rabies in Maryland from 1981 to 1986 (a period of raccoon rabies epizootic) and found that rodents and lagomorphs comprised 1.2% of the total positive reported cases (44 cases). Of these, woodchucks accounted for 35 cases. Where rodent rabies does occur, it appears to be correlated with epizootic outbreaks of raccoon or skunk rabies (Fishbein *et al.*, 1986; Moro *et al.*, 1991). There were, however, no rodent or lagomorph cases reported in Arkansas during the skunk epizootic of 1977-79 (Heidt, 1982).

Raccoons represent one of the four major wildlife rabies vectors in the United States. Previous to the late 1970's, raccoon rabies was enzootic to the southeastern United States (McLean, 1975). In 1977, a wildlife rabies epizootic began in the mid-Atlantic region of the United States. The outbreak has been linked to raccoons translocated from the southeastern United States to augment existing populations for sport hunters (Nettles *et al.*, 1979; Smith *et al.*, 1984). The numbers of raccoon rabies cases in this area were quite dramatic as evidenced by 545 reported cases in Virginia and 732 in Maryland in 1983 and in 1984 there were 281 cases in Pennsylvania and 964 in Maryland (CDC, 1984, 1985). This epizootic points out the need for caution when transporting and releasing animals between geographic areas.

In Arkansas, raccoon rabies is virtually nonexistent and only 10 cases have been reported since 1950; the most recent case reported in 1987. Recent research with monoclonal antibodies has shown that there are a number of strains which may be specific for certain species of animals (Smith, 1989). In all probability those strains for raccoons are not found in Arkansas and the rare case of rabies in raccoons represents an isolated occurrence.

In Arkansas, foxes (both red, *Vulpes fulva*, and gray, *Urocyon cinereoargenteus*) were the major wildlife vector until the mid-1960's when they were displaced by skunks. At present, fox rabies in Arkansas is negligible, accounting for less than 1% of the total reported cases.

SKUNK

There are six species of skunks (eastern spotted, *Spilogale putorius*; western spotted, *S. gracilis*; striped, *Mephitis mephitis*; hooded, *M. macroura*; hog-nose, *Conepatus mesoleucus*; and eastern hog-nose, *C. leuconotus*) in the United States, all of which have been involved in

reported cases of rabies (Verts, 1967; Parker, 1975). In the mid-1960's skunks replaced foxes as the major wildlife vector, and in recent years have accounted for 35-50% of the total reported rabies nationally (Winkler, 1986; Gremillion-Smith and Woolf, 1988). The vast majority of skunk rabies is reported from a skunk rabies belt extending from southern Texas and Louisiana north into Canada (Parker, 1975). Monoclonal antibody studies demonstrate that the skunk endemic area of North America originated in two separate regions (Smith *et al.*, 1986). One strain has been identified in the northern and eastern states, California, and Canada and the second with Kansas and Texas. Both viral strains are found in Missouri and Arkansas where the two epizootics are believed to have joined in the late 1960's (CDC, 1985). The presence of the two strains in Arkansas may compound the understanding of overall skunk rabies patterns in the state.

Arkansas is in the geographic range of the eastern spotted and striped skunk. While both species have been found positive for rabies, they are not distinguished by the Arkansas Department of Health. Lower densities and more secretive habits of the spotted skunk, however, have made the striped skunk the principle vector. Skunk rabies in Arkansas became prevalent in 1963-64, and since that time the skunk has become the major vector in the state. In the past nine years, skunks have accounted for 82.7% (71.8-90.2%) of the total reported rabies (Table 1, Fig. 2).

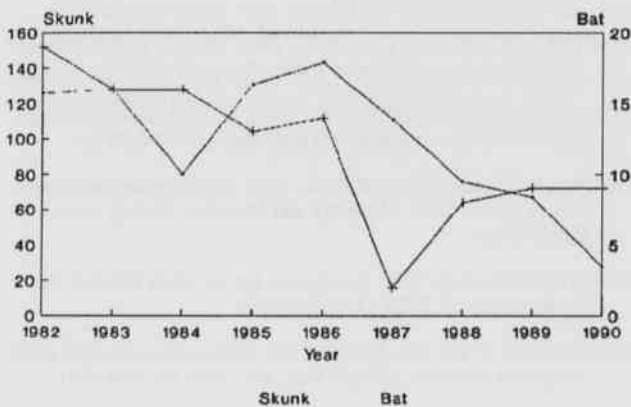


Figure 2. Reported skunk and bat rabies in Arkansas: 1982-1990.

Skunk rabies reached epizootic conditions in 1979 when a total of 301 cases were reported. During the past nine years, there has been a decline, a mild increase, and then a steady decline which reached a 20 year low of 28 reported cases in 1990 (Table 1, Fig. 2). During the epizootic years of 1977-79, Ferguson and Heidt (1980) and Heidt *et al.* (1982) conducted detailed studies into the characteristics and epidemiology of reported skunk rabies and human contact with rabid skunks. They found that March, April, and May had the highest reported incidences and that skunk rabies seemed confined to the highland areas of the state. In 1981, skunk rabies was reported in the coastal plain from Lonoke, Prairie, and Arkansas counties. Since that year, skunk rabies has been reported from most of the coastal plain counties; however, it is still most prevalent in the highland regions, averaging 69% of reported skunk rabies and ranging from 54.5% in 1986 to 78.9% in 1983.

Sixty-eight of the 75 Arkansas counties have reported skunk rabies at some point in time. The overall distribution of skunk rabies, based on data from the past nine years, indicates that 10 counties may be classified as enzootic (Table 2, Fig. 3). These ten counties have contributed 38.8% of the total skunk rabies during the past nine years. An additional 9.4% can be attributed to a one or two year outbreak in Greene, Craighead, Jackson, Stone, and Hempstead counties.

Table 2. Reported skunk rabies from ten enzootic counties in Arkansas.

County	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total
Independence	10	9	3	21	14	3	1	2	1	64
White	2	12	6	9	2	7	5	4	0	47
Johnson	9	0	3	12	7	2	0	2	2	37
Pope	9	1	0	0	4	8	1	1	9	33
Faulkner	2	2	4	14	2	2	2	2	1	31
Boone	4	11	3	4	3	1	2	0	1	29
Baxter	7	4	0	3	0	0	5	9	0	28
Columbia	2	2	6	2	1	1	2	10	2	28
Washington	2	6	5	0	3	4	6	1	1	28
Howard	4	2	4	4	4	0	0	1	1	20

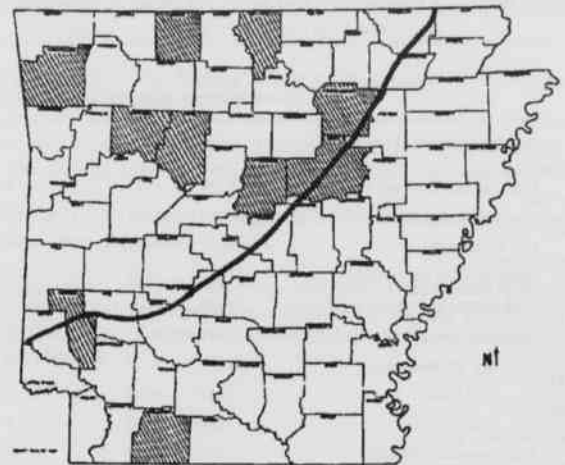


Figure 3. Ten potential enzootic skunk rabies counties in Arkansas.

The primary focus appears to be located in the Independence/White counties area. An analysis of distributional patterns for 1986-87 seems to demonstrate the importance of this focus. During 1986, Greene County reported an outbreak of 28 cases, at the same time Lawrence County reported six and Jackson County 14 cases. These contiguous counties are directly linked to Independence which had reported higher than normal cases in 1985-86. During the same time period, Stone County reported 19 cases, while the next nearest enzootic area (Baxter County) was reporting few cases. Again, the most logical source for these cases was the Independence County area. It will be interesting to follow these counties over the next several years to see if they are, in fact, the enzootic areas of the state. With the development of rabies vaccines for wildlife, the identification of enzootic foci become important adjuncts for future rabies control (Rupprecht *et al.*, 1990; Gremillion-Smith and Woolf, 1988; Bachmann *et al.*, 1990).

BAT

Bat rabies was not reported nationally until 1953 (Baer, 1975), and 1961 in Arkansas. Bats have become recognized as one of the major wildlife vectors and among the most widespread geographically in the United States (CDC, 1989). In addition, 30 of the 39 species of bats found in the continental United States have tested positive (Constantine, 1979).

In his 31 year summary of rabies in Arkansas, Heidt (1982) pointed out that reported bat rabies averaged a little over nine cases per year and accounted for 6.7% of the total reported cases in Arkansas. He also pointed out that epidemiology of bat rabies was hampered in that all 16 species of bats in Arkansas were grouped together and no identification of individual species was conducted, a situation which was corrected in 1982.

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Heidt *et al.* (1987) reported that 11 species of bats had been tested between 1982-1986 and individuals from six species had tested positive. Of those, red bats (*Lasiurus borealis*) comprised 40% of the total bats submitted and 72% of the bats which tested positive.

Examination of Table 3 shows that red bats continue to comprise 40% of the individuals tested and continue to exhibit about the same percentage in terms of the total number of positive bats (68.5%). Red bats are distantly followed by big brown bats (*Eptesicus fuscus*) and hoary bats (*L. cinereus*), with 9.0% and 7.9% respectively. In addition, hoary bats exhibited the highest percent positive with respect to submissions. The individuals in Table 3 represent 84% of the bats submitted and also testing positive for rabies.

Table 3. Summary of identified bats tested for rabies in Arkansas: 1982-90.

Species	Number Submitted/Positive (%)	Percent Total Bat Rabies
Family Vespertilionidae		
Big brown bat (<i>Eptesicus fuscus</i>)	193/8 (4.1)	9.0
Red bat (<i>Lasiurus borealis</i>)	350/61 (17.4)	68.5
Hoary bat (<i>L. cinereus</i>)	25/7 (28.0)	7.9
Evening bat (<i>Myotis cinerascens</i>)	113/3 (2.7)	3.4
Eastern pipistrelle (<i>Pipistrellus subflavus</i>)	35/5 (14.3)	5.6
Silver-haired bat (<i>Lasionycteris noctivagans</i>)	10/0 (0.0)	0.0
Gray bat (<i>Myotis grisescens</i>)	12/1 (8.3)	1.1
Little brown bat (<i>M. lucifugus</i>)	12/0 (0.0)	0.0
Keen's bat (<i>M. keenii</i>)	2/0 (0.0)	0.0
Southeastern bat (<i>M. austroriparius</i>)	1/0 (0.0)	0.0
Eastern big-eared bat (<i>Plecotus rafinesquii</i>)	4/0 (0.0)	0.0
Family Molossidae		
Free-tailed bat (<i>Tadarida brasiliensis</i>)	111/4 (3.6)	4.5
Total 666/89		100.0

Since 1986, one additional species has been tested (southeastern bat, *Myotis austroriparius*) bringing the total species tested to 12. In addition, one gray bat (*Myotis grisescens*) has tested positive, bringing the total species which have tested positive to seven. It should be noted that the gray bat is on the Federal Endangered Species List. It must be cautioned, however, that those species which have not tested positive are not necessarily rabies-free.

Over the period of this study, bats averaged 9.8% of the total reported rabies in Arkansas (ranging from 1.6% in 1987 to 23.1% in 1990). Yearly cases ranged from two in 1987 to 19 in 1982, and averaged 11.8 cases per year. No distinct pattern could be discerned, however, trends set between 1975-1981 were continued (Table 1, Fig. 2). Furthermore, most bats submitted are from urban areas and may skew the data toward species which are highly urbanized. This trend has also been observed elsewhere (Steece *et al.*, 1982) and the implications with respect to bat rabies epidemiology are unclear.

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